

Turning wastewater nutrients into fertilizer

October 20 2020



The NPHarvest method's tests at a wastewater treatment plant and a landfill met with success. Ilaria Righetto from the Master's Programme in Water and Environmental Engineering participated in the project through her master's thesis work. Credit: Aalto University

Wastewater contains large amounts of nitrogen and phosphorus, which are valuable nutrients. NPHarvest is a process developed by Aalto University researchers that allows for the recovery of these nutrients in a way that produces a clean ammonium sulfate solution, which can be used as fertilizer, and a slurry rich in phosphorus and calcium. Using the NPHarvest process to produce recycled fertilizer can save both energy and natural resources, as it reduces nutrient discharges into waterways

and cuts the amount of energy and chemicals consumed by aeration and wastewater treatment processes.

Developing a membrane

The NPHarvest process begins with the chemical coagulation of wastewater with lime dust, an industrial by-product. Coagulation allows for the harvesting of the [phosphorus](#) in the water. The separation of nitrogen in ammonium form is based on the use of a gas-permeable membrane. As an example, a biogas plant could achieve savings by using the NPHarvest process to treat its reject water on-site and turning it into fertilizer instead of conveying the water to a [wastewater treatment plant](#) and paying an increased wastewater charge.

"In the spring of this year we still had some doubts about the durability and cleaning of these membranes, as we had conducted only short-term experiments. This summer we had an opportunity to test the process over a span of several months, which also confirmed the feasibility of these membranes. We now know that the process works even in challenging environments, for example in the treatment of reject water from sludge digestion or leachate from a landfill," says Professor of Practice Anna Mikola.

Advancing circular economy with process chemicals

The strength of the NPHarvest process is that different end products can be produced from wastewater according to need. Nitrogen, for example, can be used as a general fertilizer in an ammonium phosphate form, while ammonium nitrate is used as an industrial chemical. Various organic polymers, such as starch, can be used like traditional coagulants in the recovery of phosphorus.

NPHarvest uses acid to bind nitrogen to the final product. Test runs conducted at a wastewater treatment plant in Viikinmäki also proved the feasibility of phosphoric acid for this use. In the future, phosphoric acid could be produced through the RAVITA process developed by HSY to recover phosphorus from [wastewater](#).

"The customisability and adaptability of the process are [important factors](#) in the shift toward [circular economy](#) thinking, where one person's waste is raw material for another," Mikola adds.

Provided by Aalto University

Citation: Turning wastewater nutrients into fertilizer (2020, October 20) retrieved 28 April 2024 from <https://phys.org/news/2020-10-wastewater-nutrients-fertilizer.html>

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